

P A A R A

GRAPHS



July 1986

**THE OFFICIAL NEWSLETTER
OF THE PALO ALTO AMATEUR
RADIO ASSOCIATION
AND**

THE MENLO PARK C.D. AMATEUR RADIO CLUB

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Membership in PAARA is \$6.00 per calendar year which includes a subscription to PaaraGraphs.

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Club Net 147.45 MHz Monday @ 8:30 PM

Speaker

Dr. O. G. Villard (W6QYT)

*Compact Shortwave Directional Receiving Antennas
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Mike Villard was first licensed as W8DJX in 1931, and has held the call W6QYT since October, 1938. A frequent contributor to QST, he has written articles on single-sideband transmission (W6YT was the first post-war station to use SSB); the Select-o-ject (later known as the Q multiplier); meteor burst communications; backscatter sounding, ionospheric modification, and long-delayed echoes. In recent years, his interests have shifted from propagation to antennas. He is connected with both Stanford University and SRI International.

July meeting will be held on

Friday, July 11th, 1986

at the Menlo Park Rec Center at 7:00 PM

Radio class offered in SC

The Redwood City-San Carlos Amateur Radio Emergency Service will be offering a Novice Class Amateur Radio Licensing Course at San Carlos City Hall beginning July 8.

The course will be held every Tuesday night for eight weeks, from 7:30 to 9:30 p.m. The course will be offered free of charge, but there will be a \$10 charge for the textbook, Morse Code tape, and other training materials.

Amateur radio is a hobby enjoyed by

over one million persons world-wide. It has aspects that anyone can enjoy, including satellite communication, emergency service, world-wide "short-wave" privileges, portable and mobile communications, computer aided transmissions, and much more.

But to enjoy the hobby, a person must have a license. The novice license is the easiest to receive.

For further information or to register, please call 368-8537 or 593-8952.

reprinted from the Carlmont Enquirer-Bulletin

Wednesday, July 2, 1986

(Thanks to N6CHI for submitting this contribution !)

Field Day !

Even though there was nothing formal scheduled for PAARA Field day this year, a number of people showed up and did some serious **operating**.

Ken Deuker (KB6BPM) & Alan Larson (WA6AZP) were the main **operators**, starting out around noon Sat, and staying until the contest was **over**. They were joined by a number of other people through the 24 hour period.

Bob (KA6IRT) and two of Ken's friends were there to help set up & operate the two HF stations. A 101-ZD on a dipole, and a Kenwood TS-430 on a vertical. Bands worked included 10/15/20/ & 40, CW and SSB. Johathan passed his novice code test during this time, and David got in some CW practice toward his novice license.

Pete (N06GOM ?) brought a packet station (with Andy, VE3FZK providing the Heathkit terminal) and worked a number of Packet Radio stations (not to mention the 100 point bonus !).

Jerry (N6CCM), Paul (WA6BRM) and a number of others showed up, and in addition to doing some operating, provided general moral support by being there.

Andy (VE3FZK) brought a Santec handheld and worked a number of SSB contacts (with the help of a 25 Watt amp & a Gel Cell & his now famous "Fishing Pole" ant.). In order to escape the interference from the Packet station, he ended up at the end of the nearby pier. From a distance, he appeared to be 'fishing' for contacts !

And since I don't know all the names and call signs.... thanks to the other people who helped out (little things, like bringing the trailer and 10 K Watt generator to the site !)...

Again - I thought the Field day that almost didn't happen went pretty well !

The Babbage Language

There are few things in this business that are more fun than designing a new computer language, and the very latest is Ada - the Department of Defense's new supertoy. Ada, as you know, has been designed to replace outmoded and obsolete languages such as COBOL and FORTRAN.

The problem is that this cycle takes 20 to 30 years and doesn't start until we're really convinced present languages are no good. We can short-circuit this process by starting on Ada's replacement right now. Then, by the time we decide Ada is obsolete, its replacement will be ready.

The new generation of language designers has taken to naming its brainchildren after real people rather than resorting to the usual acronyms. Pascal is named after the first person to build a calculating machine and Ada is named after the first computer programmer. As our namesake, we chose Charles Babbage, who died in poverty while trying to finish building the first computer. The new language is thus named after the first systems designer to go over budget and behind schedule.

Babbage is based on language elements that were discovered after the design of Ada was completed. For instance, C.A.R. Hoare, in his 1980 ACM Turing Award lecture, told of two ways of constructing a software design: "One way is to make it so simple that there are obviously no deficiencies and the other way is to make it so complicated that there are no obvious deficiencies". The designers of Babbage have chosen a third alternative - a language that has only obvious deficiencies. Babbage programs are so unreliable that maintenance can begin before system integration is completed. This guarantees a steady increase in the dp job marketplace.

Like Pascal, Ada uses "strong typing" to avoid errors caused by mixing data types. The designers of Babbage advocate "good typing" to avoid errors caused by misspelling words in your program. Later versions of Babbage will also allow "touch typing", which will fill a long-felt need.

A hotly contested issue among language designers is the method for passing parameters to subfunctions. Some advocate "call by name", others prefer "call by value". Babbage uses a new method - "call by telephone". This is especially effective for long distance parameter passing.

Ada stress the concept of software portability. Babbage encourages hardware portability. After all, what good is a computer if you can't take it with you.

It's a good sign if your language is sponsored by the government. COBOL had government backing, and Ada is being funded by the Department of Defense. After much negotiation, the Department of Sanitation has agreed to sponsor Babbage.

This article on 'Gelled Lead-Acid Batteries'

by Bob Lechner (W16W)

is continued from the June 1986 issue.

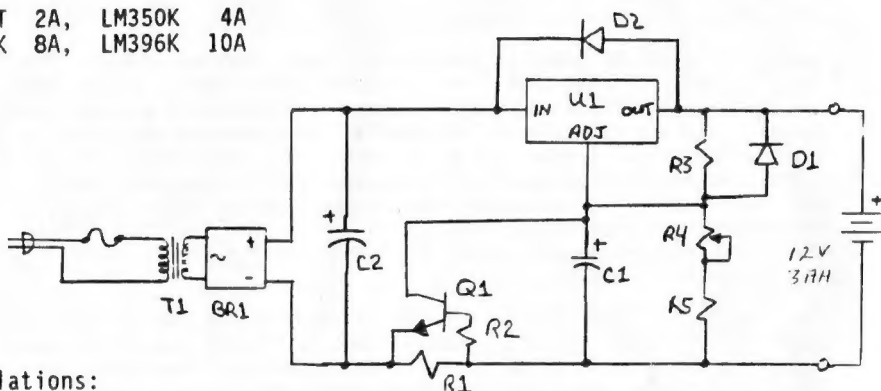
CONSTANT VOLTAGE / LIMITED CURRENT CHARGER: This circuit is a constant voltage supply with current limiting. The voltage of the supply may be set for float or rapid charge rates.

Operation: U1 is an adjustable voltage regulator which operates by holding its output 1.25V above the adjust pin level. R3, R4 and R5 are used to set the voltage output prior to current limiting. Q1, R1 and R2 limit the current provided by the regulator. As the voltage drop across R1 exceeds 600 mV, Q1 begins to turn on pulling the regulator adjust pin closer to ground. This reduces the voltage output of the regulator which in turn reduces the current passing through the load. Q1, R1 and R2 may be omitted if the current limiting feature is not required. D1 and D2 protect the regulator from various fault conditions and should not be omitted. Larger current capacity regulators may be used if needed.

U1:

LM317T 2A, LM350K 4A

LM338K 8A, LM396K 10A



Calculations:

$$V_{out} = 1.25 (1 + ((R4 + R5)/R3))$$

$$R4 + R5 = R3 ((V_{out} / 1.25) - 1)$$

Fast charge: $V_{out} = 14.7V$ (2.45 V/cell x 6) $R4 + R5 = 1302 \text{ Ohm}$

Float charge: $V_{out} = 13.5V$ (2.25 V/cell x 6) $R4 + R5 = 1186 \text{ Ohm}$

Current limit begins where voltage across R1 = 600mV

full current limit happens with voltage across R1 = 680mV

For a 600mA current limit, $R1 = 680mV / 600mA = 1.1333 \text{ Ohms}$

choose R1 = 1.2 Ohm 2 Watts

R1 1.2 ohm 2W

R2 100 ohm

R3 121 ohm

R4 500 ohm trimmer

R5 1K ohm

C1 10uF/25V

C2 1000uF/35V (use about 2000uF per ampere output current)

Note: RF bypass capacitors may be required near strong RF fields

Q1 2N3904

U1 LM317T (heatsink)

D1, D2 1N4002

BR1 diode bridge (heatsink)

T1 15V 1A

LEAD-ACID BATTERY CHARGER

Properly charging sealed lead-acid batteries is very important for long trouble free battery service. The circuit on the following page is capable of quickly and safely charging lead-acid batteries and features temperature compensation as well as two charging levels (with automatic switchover).

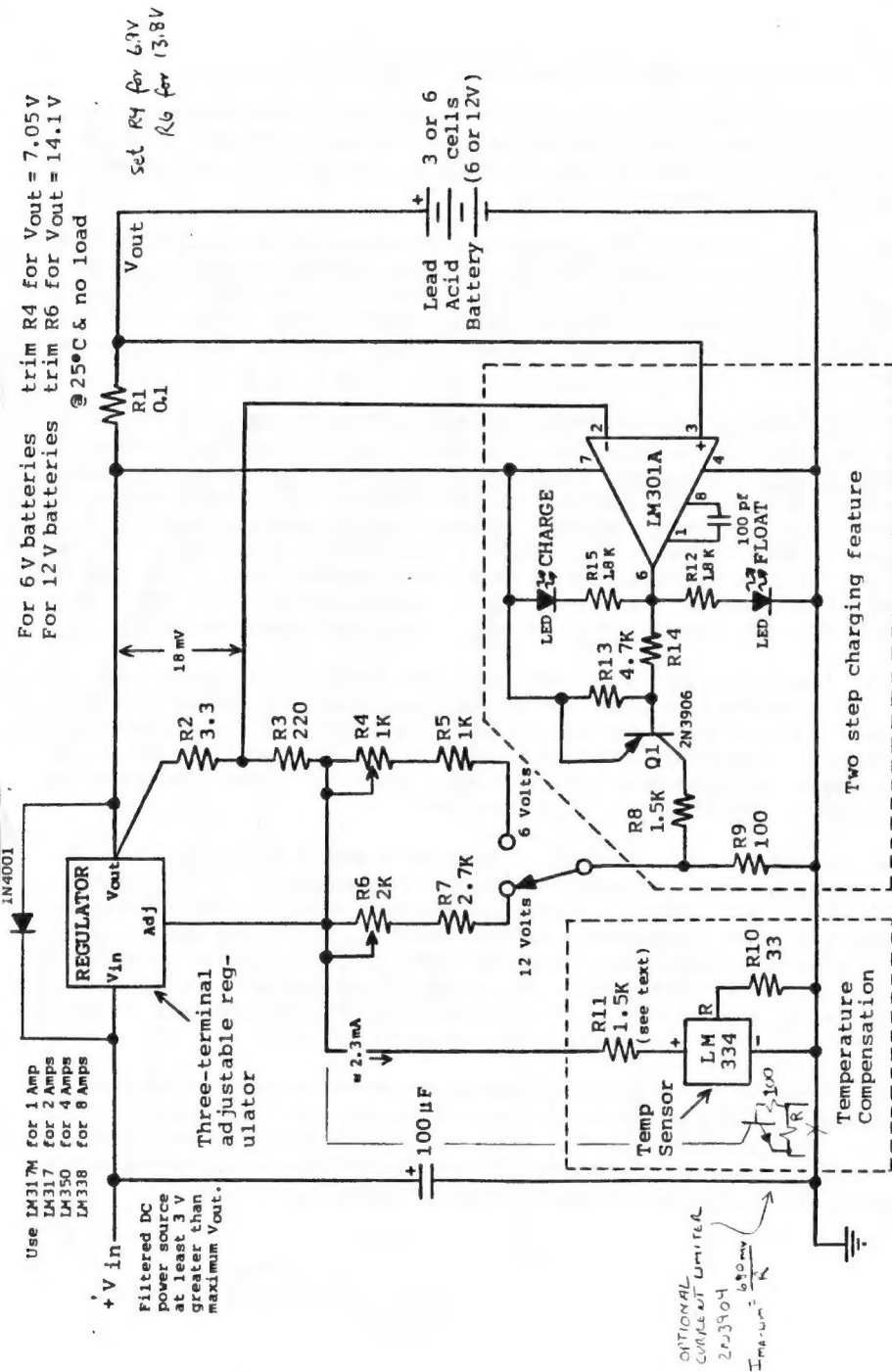
Temperature compensation in a charger is important to prevent the battery from becoming overcharged, especially if the battery is subjected to wide temperature variations. A temperature coefficient of $-4 \text{ mV}/^\circ\text{C}/\text{cell}$ at the output of the charger is provided by the LM334 current mode temperature sensor which is either located near the battery, or if high charging currents are involved, it could be attached directly to the battery.

The two-step charging feature provides a higher initial charging voltage ($2.45 \text{ V}/\text{cell}$ $2.5 \text{ volts}/\text{cell}$ @ 25°C) to rapidly bring a discharged battery up to near full charge. The amount of charging current is determined by the amount of charge remaining in the battery and the current limit of the regulator chosen. Since a constant voltage is used to charge the battery, the charging current will begin to decrease as the battery approaches a fully charged condition. When it drops below a predetermined level (180 mA in this example) the charger's output voltage drops to a float condition voltage of $2.30 \text{ volts}/\text{cell}$ @ 25°C , thus maintaining the battery in a fully charged condition. This float voltage prevents the battery from becoming overcharged, which can seriously shorten its life.

R1 & R2 determine the current level when the charger switches from a charge mode to a float mode, while R8 & R9 set the amount of voltage change. ($150 \text{ mV}/\text{cell}$) The LED's indicate which mode the charger is in (charge or float), while the amount of temperature compensation is controlled by the value of resistor R10. Lead-acid batteries require more temperature compensation at lower temperatures (-20°C), therefore decreasing R10 to 30 ohms will increase the TC to $-5 \text{ mV}/^\circ\text{C}/\text{cell}$.

When charging 7 or more cells, the following items should be kept in mind. The increased voltage across the LM334 will cause an increased amount of self heating. A small heatsink on the LM334 in addition to increasing the value of R11 will keep the sensor's temperature rise to a minimum. Also, the LED current limiting resistors, R12 & R15, must be increased in value to prevent overloading the LM301A. If desired, a constant current LED could also be used in place of the standard LED and resistor. Incidentally, do not substitute the LM301A with another op-amp unless that op amp's input common mode range includes the positive supply voltage.

A unique feature of this charger is that it provides the correct temperature coefficient and the correct amount of charge-mode voltage boost for each cell, regardless of the number of cells being charged. This feature allows the charger to be easily switched from charging a single cell to as many as 12 cells. Also, if the two-step charging feature is not required, R1, R2, & the circuitry within the dashed line are not needed.



Note: RF bypass capacitors may be required near strong RF fields.

Temperature Compensated two-step Lead-Acid Battery Charger

BATTERY STATE-OF-CHARGE INDICATOR

Both nickel-cadmium and sealed lead-acid batteries are used extensively for both back-up power or for portable equipment. Often when using battery powered equipment, it would be desirable to have some indication of the amount of charge remaining in the battery. Fortunately sealed lead-acid batteries have the unique feature that allows them to indicate their state of charge. Measuring the battery voltage after it has been setting with an open circuit for a period of time is a very good indication of its state of charge.

The curve shown in figure 1 shows the relationship between the no load battery voltage, and the amount of remaining charge, expressed in percent. This curve is accurate to approximately 20% if the battery has been open circuited for one day, and is up to 5% accurate after 5 days. This curve is also quite independent of ambient temperature.

Figure 2 contains a simple circuit that displays the amount of remaining charge in a lead-acid battery. The circuit performs as an expanded scale voltmeter utilizing a LM385 voltage reference as an adjustable zener diode in series with an analog panel meter. The meter face is labeled from 0 to 100% of remaining charge. A switch is included to select from a single 2 volt cell, a 6, or a 12 volt battery. Diode D1 protects the circuit from an accidental reversal of the input voltage, while D2 limits the amount of voltage that can appear between the positive and negative terminals of the LM385. Feedback resistors R2, R3, & R4 determine the breakdown voltage of the zener section, and R5, R6, & R7 set the meters full scale reading once the LM385 zener circuit begins conducting.

Calibration is accomplished by applying an accurate DC voltage source to different test points in the circuit (see table 1) and trimming various resistors for a full scale reading on the analog meter. The resistor values shown in the schematic are trimmed values obtained by either series or parallel combinations of resistors. Precision 1% resistors are used for their stability. If desired, stable trim pots (with series resistors to reduce the trim range) could be used to simplify the calibration procedure. Due to LM385 reference voltage variations and differences in meter sensitivities, the resistor values shown in the schematic are subject to change. Also, the meter used should not be less than 1 mA, or have a voltage drop across it greater than 210 mV.

The LM385 is a micro-power bandgap shunt type voltage reference with an output that is adjustable from 1.25 to 5.3 volts using two external resistors. Voltages above 5.3 volts are also possible but an additional zener diode is required in the negative terminal of the LM385 to assure that the maximum voltage between the + and - terminals does not exceed 5.3 volts. The drift or the dynamic impedance of this added zener does not affect the overall stability of the LM385 circuit, because it is located in the LM385 feedback loop.

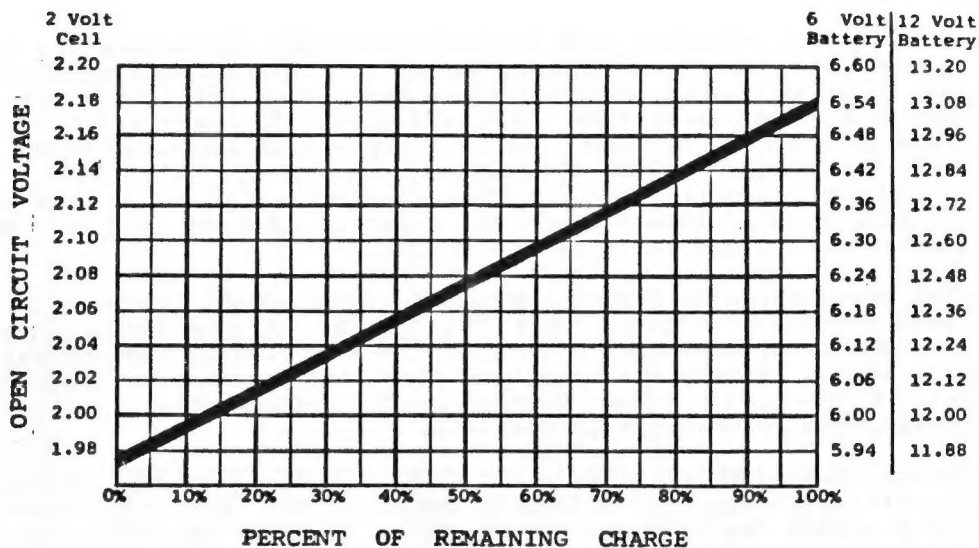


Figure 1

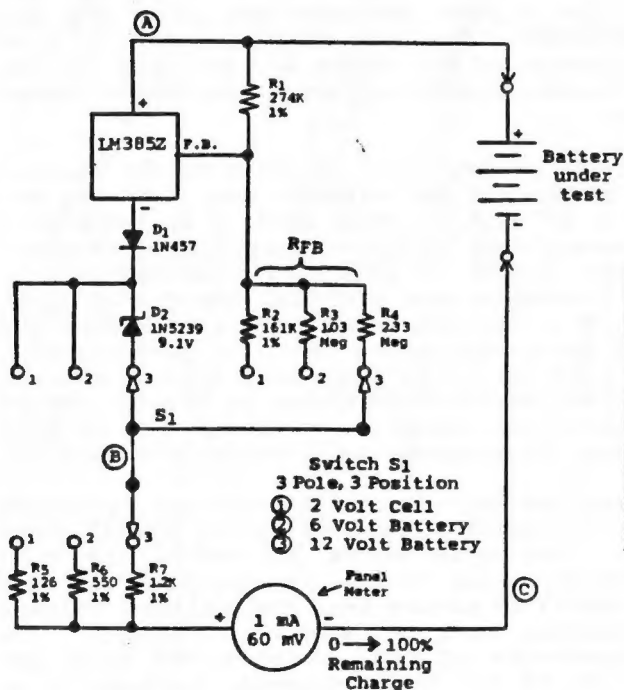


Figure 2

Switch position (S1)	DC Voltage applied between points B & C	Select resistor for full scale reading on meter
1	210 mV	R5
2	630 mV	R6
3	1.260 V	R7
DC voltage applied between points A & C		
1	2.18 V	R2
2	6.54 V	R3
3	13.08 V	R4

Table 1 (Calibration)

references:

"Power-Sonic Rechargeable Sealed Lead-Acid Batteries"
Power-Sonic Corp.
P.O. Box 522, 3106 Spring Street
Redwood City, Ca. 94036
(415) 364-5001

"Lead-acid Battery Charger" and "State-of-Charge Meter"
Fran Hoffart
National Semiconductor Corp.
Santa Clara, Ca.

"rechargeable batteries Charging Manual"
Globe Battery Division
Globe-Union Inc.
5757 North Green Bay Ave.
Milwaukee, Wisconsin 53201
(414)228-2394

"Gates CYCLON Battery Application Manual"
Gates Energy Products
1050 S. Broadway
P.O. Box 5887
Denver, Co. 80217
(303) 744-4806

"the Carefree Force - Maintenance-free Rechargeables with Immobilized Electrolyte"
Eagle-Picher Industries, Inc.
Commercial Products Department
P.O. Box 130
Seneca, Mo. 64865
(417)776-2258

Gelled Lead-Acid Batteries; The Saga Continues.

- or -

Corrections and Additions...

There were several minor errors in last month's article. First is the distinction between gell-type batteries and absorbed electrolyte units. Both battery types are sealed lead-acid batteries and both solve the same problem: if you tip a standard liquid-electrolyte battery, the electrolyte will flow down-hill leaving the top plates dry. In gell-type batteries, the electrolyte is thickened by the addition of silica, and so does not flow. In the newer absorbed electrolyte batteries, separator material such as glass cloth between the plates keeps the electrolyte from flowing. At this time most manufacturers are producing, or moving to, the absorbed electrolyte construction for reasons including lower manufacturing cost.

The second error in the article concerns the recommended charging voltages and currents. Rather than claim a significant distinction between the two construction types, it is safer and more accurate to refer you to the manufacturers' specifications for a particular battery. While there are differences between batteries (size of plates, amount of electrolyte, etc.), it is difficult to reach safe generalizations. The two battery types are very similar and charging parameters usually reflect trade-offs between speed of charge and battery life.

The third point to clarify concerns battery rest voltage. Some gelled batteries (such as my Globe) will indeed return to about 2.12 volts/cell a short while after charging as claimed in the first paper. I don't know if this is characteristic of all gell-type batteries. Absorbed electrolyte types remain at a higher voltage after charging and this rest voltage may be used as an indication of charge state for an absorbed electrolyte battery. 2.15 volts/cell seems to be a better figure to use for a fully charged battery. Refer to fig. 3 from last month and the state-of-charge measurement circuit for more information on this curve.

A point which was possibly not emphasized strongly enough in the earlier paper: unlike NiCad batteries, it is not good to 100% discharge lead-acid batteries. If size, weight and cost are not prohibitive, use a larger battery than absolutely necessary. This will allow you to use only relatively shallow discharge which can substantially extend battery life.

My thanks to many of you for your comments, information and suggestions. Additional thanks to Bruno Ender of Power-Sonic for several conversations and for reading and commenting on both parts of this paper (unfortunately, after the first section had been distributed).

A FINAL REQUEST: If copies of the article are to be made, please include this last page of corrections, or better still, contact me for a copy of the revised version.

continued from page 2

The Babbage Language

No subsets of Ada are allowed. Babbage is just the opposite. None of Babbage is defined except its extensibility - each user must define his own version. To end the debate of large language versus small, Babbage allows each user to make the language any size he wants. Babbage is the ideal language for the "me" generation. The examples that follow will give some idea of what Babbage looks like.

Structured languages banned GOTOs and multiway conditional branches by replacing them with the simpler IF-THEN-ELSE structure. Babbage has a number of new conditional statements that act like termites in the structure of your program:

- **WHAT IF** - Used in simulation languages. Branches before evaluating test conditions.
- **OR ELSE** - Conditional threat, as in: "Add these two numbers OR ELSE!
- **WHY NOT?** - Executes the code that follows in a devil-may-care fashion.
- **WHO ELSE?** - Used for polling during I/O operations.
- **ELSEWHERE** - This is where your program really is when you think it's here.
- **GOING GOING GONE** - For writing unstructured programs. Takes a random branch to another part of your program. Does the work of 10 GOTOs.

For years, programming languages have used "FOR", "DO UNTIL", "DO WHILE", etc. to mean "LOOP". Continuing with this trend, Babbage offers the following loop statements:

- **DON'T DO WHILE NOT** - This loop is not executed if the test condition is not false (or if it's Friday afternoon).
- **DIDN'T DO** - The loop executes once and hides all traces.
- **CAN'T DO** - The loop is pooped.
- **WON'T DO** - The cpu halts because it doesn't like the code inside the loop. Execution can be resumed by typing "May I" at the console.
- **MIGHT DO** - Depends on how the cpu is feeling. Executed if the cpu is "up", not executed if the cpu is "down", or if its feelings have been hurt.
- **DO UNTO OTHERS** - Used to write the main loop for timesharing systems so that they will antagonize the users in a uniform manner.

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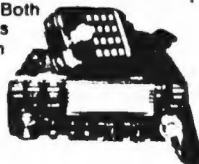
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Hwy. 17 to 23rd Ave. Exit

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5375 Kearny Villa Rd.
(619) 560-4900 Glenn Mgr. K6NA
Hwy. 163 & Claremont Mesa Blvd

PHOENIX, AZ 85015
1702 W. Camelback Rd.
(602) 242-3515 Bob, K7RDH
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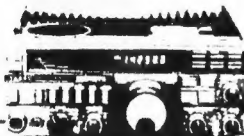


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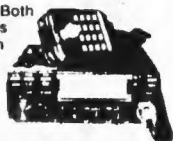
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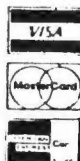
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